

U.S. Hydropower Resource Assessment for South Carolina

**Prepared by:
Alison M. Conner
James E. Francfort**

**Project Manager:
Ben N. Rinehart**

Published June 1997

**Idaho National Engineering and Environmental Laboratory
Renewable Energy Products Department
Lockheed Martin Idaho Technologies Company
Idaho Falls, Idaho 83415**

**Prepared for the
U.S. Department of Energy
Assistant Secretary for Energy Efficiency and Renewable Energy
Under DOE Idaho Operations Office
Contract DE-AC07-94ID13223**

ABSTRACT

The U.S. Department of Energy is developing an estimate of the undeveloped hydropower potential in the United States. To assist in providing this estimate, the Idaho National Engineering Laboratory^a developed the Hydropower Evaluation Software (HES) computer model. HES measures the undeveloped hydropower resources available in the United States, using uniform criteria for measurement. The software was developed and tested using hydropower information and data provided by the Southwestern Power Administration. It is a menu-driven program that allows the personal computer user to assign environmental attributes to potential hydropower sites, calculate development suitability factors for each site based on the environmental attributes present, and generate reports based on these suitability factors. This report describes the resource assessment results for the State of South Carolina.

a. In January 1997, the name of the Idaho National Engineering Laboratory (INEL) was changed to the Idaho National Engineering and Environmental Laboratory (INEEL). INEEL will be used throughout the text of the document, except where use of INEL is historically important.

ACKNOWLEDGMENTS

The authors thank Peggy A. M. Brookshier and John V. Flynn of the U.S. Department of Energy and George D. Ballentine of the State of South Carolina for their active participation and timely comments.

CONTENTS

ABSTRACT	iii
ACKNOWLEDGMENTS	v
INTRODUCTION	1
Model Development	1
Model Goal.....	1
Dam Status	2
ASSESSMENT RESULTS	2
Summary Results	2
Detailed Results.....	6
OBTAINING INDIVIDUAL STATE INFORMATION	6
ADDITIONAL HYDROPOWER EVALUATION SOFTWARE INFORMATION	7
REFERENCES	9
Appendix A–Summary Report	A-1
Appendix B–River Basins Report	B-1
Appendix C–South Carolina Sites List	C-1
Appendix D–Individual Resource Database List	D-1

FIGURES

1. Number of sites, by capacity groups, with HES-modeled undeveloped hydropower potential	3
2. The nonmodeled and HES-modeled undeveloped hydropower potential	3
3. The number of sites with undeveloped hydropower potential and the total megawatts of HES-modeled undeveloped hydropower potential	4
4. The W. C. Bowen Lake Dam reservoir, located on the South Fork of the Pacolet River, is one of the water sources for Spartanburg, South Carolina	4
5. The Prestwood Lake Dam, in Darlington County, provides process water for the Sonoco Products plant in Hartsville, South Carolina. The plant is pictured in the background	5
6. Number of sites with undeveloped hydropower potential in the South Carolina river basins	5
7. Megawatts of HES-modeled undeveloped hydropower potential in the South Carolina river basins	6

TABLES

1. Undeveloped hydropower potential summary for South Carolina	2
--	---

U.S. Hydropower Resource Assessment for South Carolina

INTRODUCTION

In June 1989, the U.S. Department of Energy initiated the development of a National Energy Strategy to identify the energy resources available to support the expanding demand for energy in the United States. Public hearings conducted as part of the strategy development process indicated that undeveloped hydropower resources were not well defined. As a result, the Department of Energy established an interagency Hydropower Resource Assessment Team to ascertain the undeveloped hydropower potential. In connection with these efforts by the Department of Energy, the Idaho National Engineering Laboratory designed the Hydropower Evaluation Software (HES), which has been used to perform a resource assessment of the undeveloped conventional hydropower potential in over 40 states. This report presents the results of the hydropower resource assessment for the State of South Carolina. Undeveloped pumped storage hydropower potential is not included.

The HES was developed as a tool to measure undeveloped hydropower potential regionally or by state. The software is not intended to provide precise development factors for individual sites, but to provide regional or state totals. Because the software was developed as a generic measurement tool encompassing national issues, regional and state totals must be considered judiciously; various local issues may skew undeveloped hydropower potential totals. The information for the resource assessment was compiled from the Federal Energy Regulatory Commission's Hydroelectric Power Resources Assessment database and several other sources. Refer to DOE/ID-10338, the *User's Manual* (Francfort, Matthews, Rinehart 1991) for the specifics of the software and to DOE/ID-10430.1, the *Status Report* (Conner, Francfort, Rinehart 1996) for an overview of all resource assessment activities to date.

Model Development

Hydropower Evaluation Software, both a probability-factor computer model and a database, is a menu-driven program that is intended to be user-friendly. Computer screens and report-generation capabilities were developed to meet the needs of users nationwide. The software uses environmental attribute data to generate an overall project environmental suitability factor (PESF) between 0.1 and 0.9, where 0.9 indicates the highest likelihood of development and 0.1 indicates the lowest likelihood of development. The suitability factors are dependent on the unique environmental attributes of each potential site. They reflect the considerations that (a) environmental concerns can make a potential site unacceptable, prohibiting its development (for a suitability factor of 0.1), or (b) if there are no environmental concerns, there is no negative effect on the likelihood of site development (for a suitability factor of 0.9). A combination of attributes can result in a lower suitability factor because multiple environmental considerations would reduce the likelihood that a site may be developed to its physical potential.

Model Goal

The goal of the HES is to assemble an accurate resource database of all sites with undeveloped hydropower potential in the United States for use as a planning tool to determine the viable national hydropower potential. Undeveloped hydropower potential is not limited to the development of new sites; it also includes the development of additional hydropower-generating capacity at sites that currently have hydropower, but are not developed to their full potential. This undeveloped hydropower potential is a source of nonpolluting, renewable energy available to meet the growing power needs of the United States. The HES should help make this goal obtainable and ensure a set of uniform criteria for national assessment.

Dam Status

The effects of environmental attributes vary by dam status. The dam status classifications used are as follows:

- W = Developed hydropower site with current power generation, but the total hydropower potential has not been fully developed. Only the undeveloped hydropower potential is discussed in this report.
- W/O = Developed site without current power generation. The site has some type of developed impoundment or diversion structure, but no developed hydropower generating capability.
- U = Undeveloped site. The site does not have power generation capability nor a developed impoundment or diversion structure.

ASSESSMENT RESULTS

Summary Results

A total of 49 sites (Table 1) have been identified and assessed for their undeveloped hydropower potential. The HES results for indi-

vidual site capacities range from 12.5 kilowatts (kW) to 125 megawatts (MW). The majority of the sites (65%) have potential capacities of greater than 1 MW (Figure 1).

The nonmodeled undeveloped hydropower potential total for South Carolina was identified as 1,133 MW. The HES results lower this estimate about 58% to 480 MW. The greatest reduction in undeveloped hydropower potential, by MW, occurs at sites with no current power generation capability nor impoundment or diversion structure in place (Undeveloped category). The unadjusted potential for these sites is 273 MW, and the HES-modeled capacity is 33 MW, an 88% reduction in the estimated undeveloped hydropower potential (Figure 2). Figure 3 shows that the developed sites with power have the smallest HES-modeled average capacity per site (1.7 MW), and the developed sites without power have the highest HES-modeled average capacity per site (14.3 MW). Figures 4 and 5 show examples of two sites with undeveloped hydropower potential in South Carolina.

The 49 identified sites are located within 3 major river basins. The number of sites per major river basin range from 2 in the Yadkin-Pee Dee River Basin to 41 in the Santee River Basin (Figure 6). The Santee River Basin has the most undeveloped hydropower potential (453 MW) of the South Carolina river basins (Figure 7). It should be noted that the Santee River Basin reports to having only four sites to develop to obtain 69% (313 MW) of its undeveloped hydropower capacity.

Table 1. Undeveloped hydropower potential summary for South Carolina. The table contains the non-modeled undeveloped nameplate potential and the HES-modeled undeveloped hydropower potential totals.

	Nameplate potential		HES-modeled potential
	Number of projects	(MW)	(MW)
With Power	2	5.9	3.3
W/O Power	31	854.6	444.2
Undeveloped	16	272.7	32.8
State Total	49	1,133.2	480.3

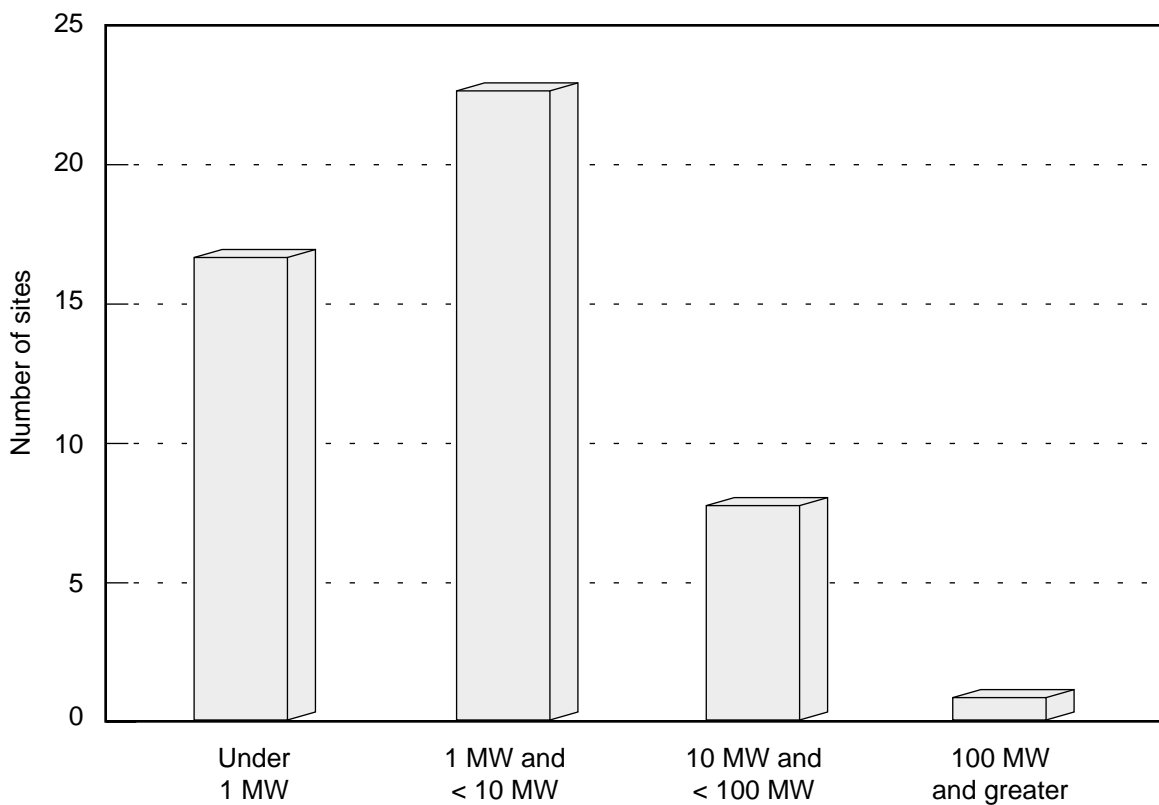


Figure 1. Number of sites, by capacity groups, with HES-modeled undeveloped hydropower potential.

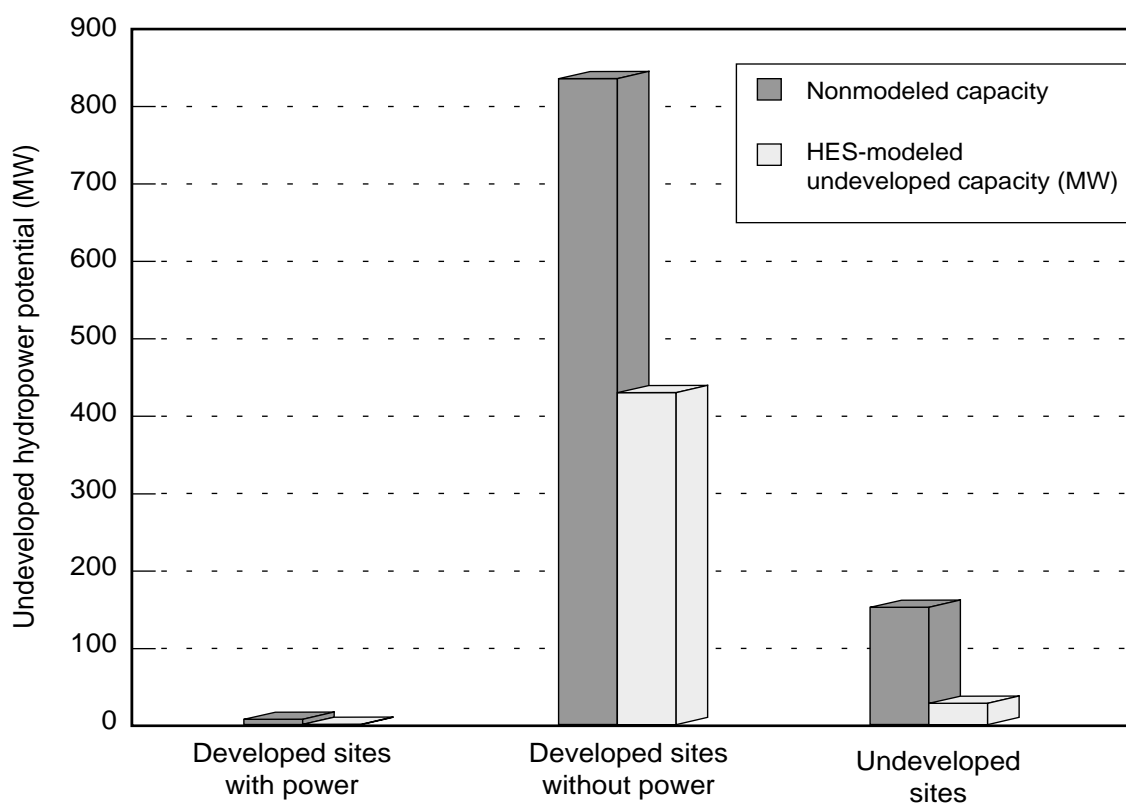


Figure 2. The nonmodeled and HES-modeled undeveloped hydropower potential.

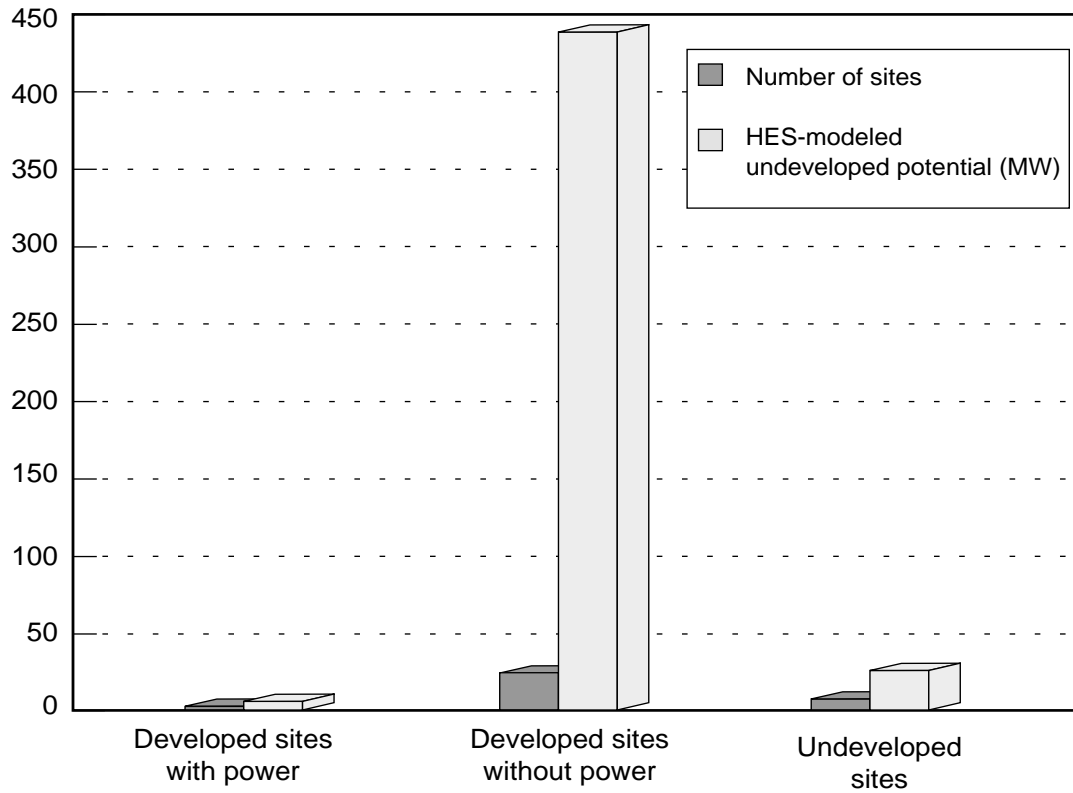


Figure 3. The number of sites with undeveloped hydropower potential and the total megawatts of HES-modeled undeveloped hydropower potential.

Figure 4. The W. C. Bowen Lake Dam reservoir, located on the South Fork of the Pacolet River, is one of the water sources for Spartanburg, South Carolina.

Figure 5. The Prestwood Lake Dam, in Darlington County, provides process water for the Sonoco Products plant in Hartsville, South Carolina. The plant is pictured in the background.

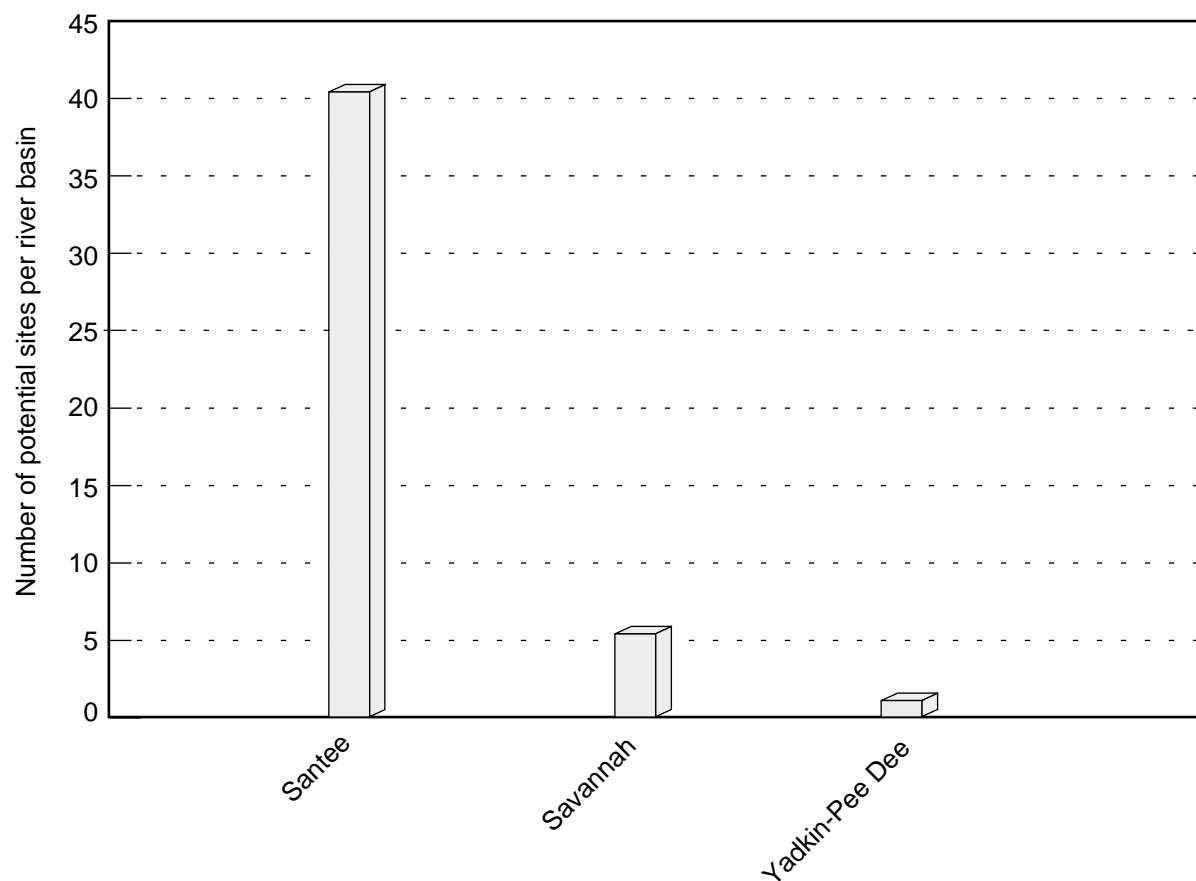


Figure 6. Number of sites with undeveloped hydropower potential in the South Carolina river basins.

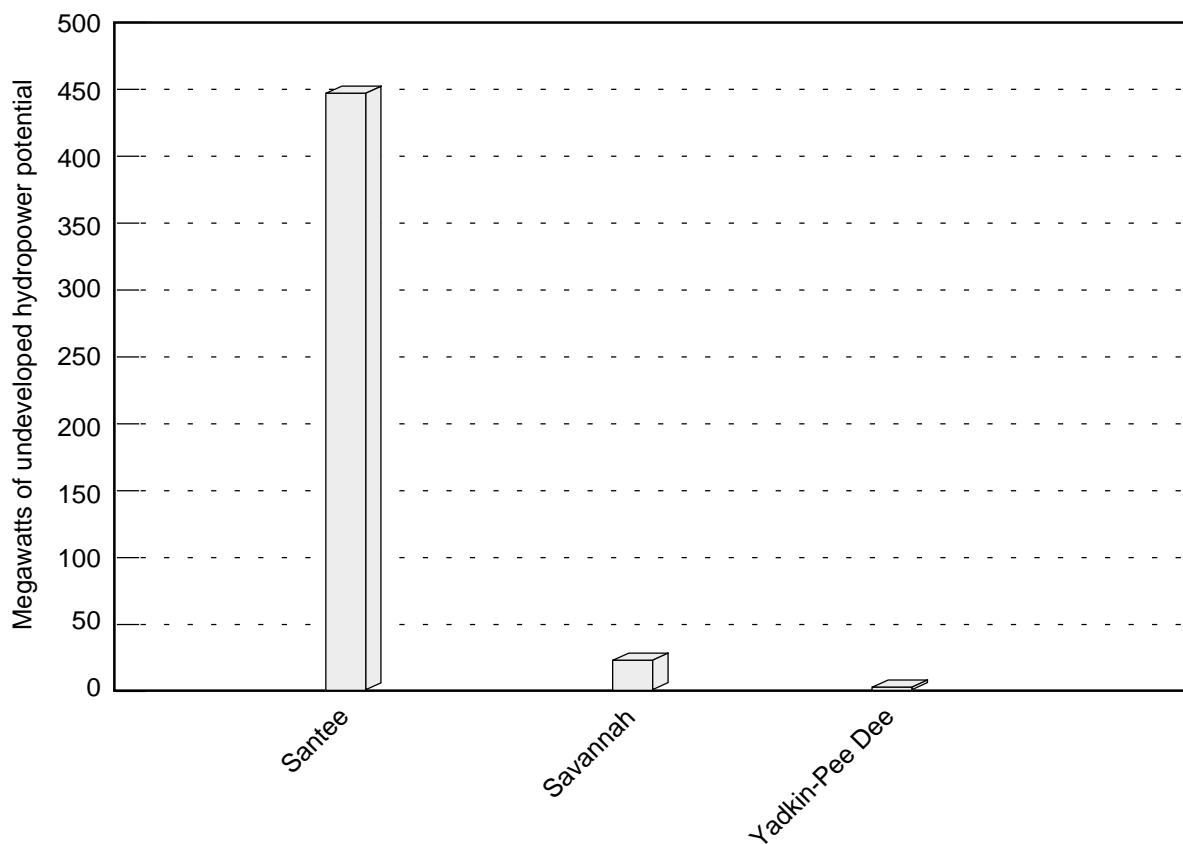


Figure 7. Megawatts of HES-modeled undeveloped hydropower potential in the South Carolina river basins.

DETAILED RESULTS

The appendices contain, in the form of HES-generated reports, detailed information about the undeveloped hydropower potential in South Carolina. The appendices contain the following information:

Appendix A summarizes the undeveloped hydropower potential by dam status groups. The number of sites, nonmodeled undeveloped hydropower potential, and HES-modeled undeveloped hydropower potential is provided based on the dam status.

Appendix B provides the hydropower resource assessment by river basin, which includes the project number, project name, stream name, dam status, nonmodeled undeveloped hydropower potential, and the HES-mod-

eled undeveloped hydropower potential for each of the individual sites. Subtotals are provided for each river basin.

Appendix C provides the hydropower resource assessment by FERC number, which includes the project numbers, plant name, stream name, if a site is Federally owned, nonmodeled undeveloped hydropower potential, and HES-modeled undeveloped hydropower potential. The sites are grouped by dam status.

Appendix D contains a resource database list for each of the 49 sites in South Carolina. Information includes plant name, stream, state, county, river basin and owner names, project number, nameplate and HES-modeled undeveloped hydropower potential, the unit and plant types, dam status, latitude, longitude, and the environmental factors that the HES uses to determine the project environmental suitability factor.

OBTAINING INDIVIDUAL STATE INFORMATION

Additional copies of the hydropower resource assessment results for individual states are available and can be obtained by writing or calling the authors or the National Technical Information Service (NTIS).

Telephone Orders—(703) 487-4650. NTIS sales desk and customer services are available between 8:30 a.m. and 5:00 p.m., EST.

Fax—(703) 321-8547. Customers may fax their orders to NTIS. These orders may be charged to a NTIS deposit account, American Express, VISA, or MasterCard.

Mail Orders—Mail orders should be sent to National Technical Information Service, Document Sales, 5285 Port Royal Road, Springfield, VA 22161. Call the sales desk for prices before placing an order.

E-Mail—Customers may e-mail requests to info@ntis.fedworld.gov.

Method of Payment—Customers may pay for reports (and other NTIS products and services) by (a) credit card (American Express, Visa or MasterCard); (b) check or money order on a United States bank payable to NTIS; (c) an NTIS deposit account; or, (d) by asking to be billed (add \$7.50 per order), United States, Canada, and Mexico, only.

Handling Fee—A \$4 handling fee per total order applies to orders from the United States, Canada, and Mexico. Handling charges do not apply to rush order service or pick-up orders.

Postage and Shipping—Orders are shipped first class mail, or equivalent, to addresses in the United States, Canada, and Mexico.

Order Turnaround Time—Orders for technical reports generally are shipped within 3 to 5 days of receipt. For faster service, NTIS offers rush order service.

Rush Order Service—Call 1-800-533-NTIS.

In Virginia, Canada, and Mexico call (703) 487-4700. For NTIS rush order service add \$15 per item. This guarantees that an order will be processed through NTIS within 24 hours of its receipt. These orders receive immediate, individual attention. The items ordered are delivered by first class mail. Call NTIS for information on rush order service for computer products.

For Help in Tracing an Order—Call (703) 487-4650 and request the customer service option.

ADDITIONAL HYDROPOWER EVALUATION SOFTWARE INFORMATION

Additional information concerning the HES can be obtained by contacting Ben Rinehart or Jim Francfort at the addresses provided below. Copies of the software and the User's Manual may also be obtained from these individuals.

Ben Rinehart, Project Manager
Idaho National Engineering and Environmental Laboratory
P.O. Box 1625, MS 3830
Idaho Falls, ID 83415-3830
(208) 526-1002

Jim Francfort
Idaho National Engineering and Environmental Laboratory
P.O. Box 1625, MS 3830
Idaho Falls, ID 83415-3830
(208) 526-6787

Information concerning the State of South Carolina's involvement with the resource assessment or about the identified sites may be obtained by contacting:

George D. Ballentine, Ph.D., P.E.
Manager, Dams & Reservoirs Safety Section
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201-1708
(803) 734-9119

REFERENCES

- Conner, A. M., J. E. Francfort, and B. N. Rinehart, 1996, *Uniform Criteria for U.S. Hydropower Resource Assessment, Hydropower Evaluation Software Status Report-II*, DOE/ID 10430.1, Idaho National Engineering Laboratory, Idaho Falls, Idaho.
- Francfort, J. E., S. D. Matthews, and B. N. Rinehart, 1991, *Hydropower Evaluation Software User's Manual*, DOE/ID-10338, Idaho National Engineering Laboratory, Idaho Falls, Idaho.